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STALLMAN & POLLOCK LLP
353 SACRAMENTO STREET
SUITE 2200
SAN FRANCISCO, CA 94111

EXAMINER	
BARBEE, MANUEL L	
ART UNIT	**PAPER NUMBER**
2857	

DATE MAILED: 12/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/801,023	OPSAL ET AL.
	Examiner	**Art Unit**
	Manuel L. Barbee	2857

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 October 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-35* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-7, 16-25, 29-33 and 35 are rejected under 35 U.S.C. 102(e) as being anticipated by Engelhard et al. (US Patent No. 6,791,679).

With regard to taking a first optical metrology measurement and determining first parameters, as shown in claim 1, Engelhard et al. teach using optical metrology to determine a develop inspect (DI) and using a correlation to predict a final inspect (FI) (col. 8, line 26- col. 9, line 58, esp. col. 8, lines 37-45 and col. 8, line 64 - col. 9, line 5 Figure 4). With regard to taking a second optical metrology measurement and determining second parameters based on the first parameters and the second measurement, as shown in claim 1, Engelhard et al. teach measuring a FI and using the measured FI and the measured DI to calculate a correlation if the measured FI differs from the predicted FI (col. 9, lines 22-47).

With regard to a first metrology tool making a first measurement after a first step in a fabrication process, as shown in claim 20, Engelhard et al. teach measuring DI after a photoresist coating (col. 8, lines 26 - col. 9, line 5; Figure 4, steps 415 - 425). With

regard to a second metrology tool making a second measurement after a subsequent step in the fabrication process and using the second measurement along with the first parameters to determine second parameters, as shown in claim 20, Engelhard et al. teach measuring an (FI) after an etch process and using the DI along with the FI to calculate a correlation if the measured FI differs from the predicted FI (col. 9, lines 22-47; Figure 4, steps 465-475).

With regard to taking a first optical metrology measurement and determining first parameters, as shown in claim 35, Engelhard et al. teach using optical metrology to determine a develop inspect (DI) and using a correlation to predict a final inspect (FI) (col. 8, line 26- col. 9, line 58, esp. col. 8, lines 37-45 and col. 8, line 64 - col. 9, line 5 Figure 4). With regard to taking a second optical metrology measurement and determining second parameters using on the a feature model, where at least one first parameter is used to reduce the number of fitting parameters in the feature model, and the second measurement, as shown in claim 1, Engelhard et al. teach using a previous correlation and DI to predict FI and measuring a FI and using the measured FI and the measured DI to calculate a correlation if the measured FI differs from the predicted FI (col. 8, lines 45-54; col. 9, lines 22-58). DI is the first parameter and is therefore used to reduce the number of parameters that need to be changed. The previous correlation is also the model that is used to determine the second parameter, a new correlation, if necessary.

With regard to retaining the first parameters in memory for use in determining the second parameters, as shown in claim 2, Engelhard et al. teach saving the DI

measurement and using the DI measurement and the predicted FI to adjust the correlation between DI and FI (col. 8, lines 45-54; col. 9, lines 30-58). With regard to determining critical dimension, as shown in claims 3 and 22, Engelhard et al. teach determining critical dimension (col. 3, lines 10-23). With regard to passing the first parameters to a tool for executing the subsequent step, as shown in claim 4, Engelhard et al. teach using the DI and the predicted FI to determine whether to adjust parameters in the recipe before continuing with the lithographic process (col. 8, line 55 - col. 9, line 5).

With regard to using a feature model to determine the second parameters, as shown in claims 5 and 24, Engelhard et al. teach using a correlation to predict the FI and updating the initial correlation (col. 8, line 64 - col. 9, line 5; col. 6, line 48 - col. 8, line 25). With regard to fixing at least one parameter in the feature model using the retained first parameters, as shown in claims 6 and 25, Engelhard et al. teach updating the correlation with the measured DI (col. 9, lines 30- col. 10, line 3). With regard to selecting the feature model after the subsequent step, as shown in claim 7, Engelhard et al. teach using identification data to match to the saved data at the DI phase before updating the correlation (col. 9, lines 48-53). The correlation is the model and by using the proper identification, correlation to the proper wafer, location and tool is achieved.

With regard to using a theoretical model to calculate a predicted optical signal characteristic and adjusting the measurement parameters in the model to minimize discrepancies between the predicted signal and the measured signal, as shown in claims 16 and 30, Engelhard et al. teach using the correlation to predict an FI and using

the actual DI and actual FI to update the correlation (col. 8, line 64 - col. 9, line 6; col. 9, lines 48-57). With regard to using the first parameters to reduce the number of measurement parameters adjusted, as shown in claims 17 and 31, Engelhard teach using the DI to predict an FI and comparing the actual FI to the predicted FI to verify the validity of the correlation (col. 9, lines 48-57).

With regard to selecting a set of trial values to be used in the theoretical model, wherein the values for any measurement parameters corresponding to the first parameters are fixed to the values of the corresponding first parameters, as shown in claims 18 and 32, Engelhard teach determining an initial correlation and using DI to adjust the correlation (col. 8, lines 14-25; col. 8, lines 29-37). With regard to an automated fitting optimization algorithm to adjust the measurement parameters, as shown in claims 19 and 32, Engelhard et al. teach matching the output FI with the FI in the library using a goodness-of-fit criteria (col. 4, lines 12-47; col. 9, lines 30-47).

With regard to the first and second metrology tool being one metrology tool, as shown in claim 21, Engelhard et al. teach one metrology tool (Fig. 2, Fig. 4). With regard to passing the first parameters to the second metrology tool, as shown in claim 23, Engelhard et al. teach using the DI along with the second measurement of the FI to calculate the correlation (col. 8, lines 26 - col. 9, line 58). With regard to measuring reflected light, as shown in claim 29, Engelhard et al. teach measuring reflected light (Fig. 2).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Engelhard et al. in view of Bruggeman (US Patent No. 6,054,710).

Engelhard et al. teach all the limitations of claim 1 upon which claim 8 depends. Engelhard et al. do not teach performing a three-dimensional characterization of the features being examined, as shown in claim 8. Bruggeman teaches determining a three-dimensional characterization of the structure under test (col. 6, lines 30-67; col. 8, line 66 - col. 9, line 4). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the optical metrology device, as taught by Engelhard et al., to include determining three-dimensional characterization, as taught by Bruggeman, because then the measurements would have contained more information than one or two dimensional measurements (Bruggeman, col. 2, lines 29-51).

5. Claims 9-14, 26-28 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engelhard in view of Piwonka-Corle et al (US Patent No. 5,608,526).

Engelhard et al. teach all the limitations of claim 1 upon which claims 9-14 depend and claim 20 upon which claims 26-28 and 34 depend. Engelhard et al. do not teach a broadband light source or focusing the broadband light source with a focusing lens, a focusing mirror or a narrowing aperture, as shown in claims 9, 10 and 26.

Engelhard et al. do not teach polarizing the light from the broadband light source using a polarizing element, as shown in claims 12 and 27. Engelhard et al. do not teach using light of multiple wavelengths, as shown in claims 12 and 28. Engelhard et al. do not teach taking a measurement using a spectrometer, as shown in claims 13 and 34. Engelhard et al. do not teach that the characteristics are reflection intensity, polarization state or angular distribution, as shown claim 14.

Piwonka-Corle et al. teach focusing a broadband light source using a focusing mirror (Abstract; col. 7, lines 41-64; Figure 1, mirror 4). Piwonka-Corle et al. teach using a polarizing element between the light source and the sample (col. 7, lines 28-40; Figure 1, polarizer 5). Piwonka-Corle et al. teach using a range of UV wavelengths (col. 3, lines 10-35). Piwonka-Corle et al. teach using a spectrometer to measure the reflected radiation (col. 4, lines 12-23). The spectrometer would measure the intensity.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the optical metrology device, as taught by Engelhard et al., to include focusing a broadband light source with a mirror, as taught by Piwonka-Corle et al., because then the instrument would have been sensitive to film variations on silicon substrates (Piwonka-Corle et al., col. 7, lines 41-64). It would further have been obvious to one of ordinary skill in the art at the time the invention was made to modify optical metrology device, as taught by Engelhard et al., to include a polarizing element, as taught by Piwonka-Corle et al., because then the polarization state would have been known (Piwonka-Corle et al., col. 1, lines 21-40). It would further have been obvious to one of ordinary skill in the art at the time the invention was made to modify the optical

metrology device, as taught by Engelhard et al., to include using a range of wavelengths, as taught by Piwonka-Corle et al., because then the changes in light of different wavelengths would have been available for measurements. It would further have been obvious to one of ordinary skill in the art at the time the invention was made to modify the optical metrology device, as taught by Engelhard et al., to include a spectrometer for measuring the intensity of the reflected light, as taught by Piwonka-Corle et al., because then photodiodes would have been sensitive to light of different wavelengths (Piwonka-Corle et al., col. 4, lines 12-23).

6. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Engelhard et al. in view of Krishnan et al. (US Patent No. 6,710,890).

Engelhard et al. teach all the limitations of claim 1 upon which claim 15 depends. Engelhard et al. do not teach feeding the first parameters to a second tool where first and second metrology measurements are taken using respective first and second metrology tools, as shown in claim 15. Krishnan et al. teach a first optical sensor and a second optical sensor and calibrating the second sensor based on the first sensor and using both sensors to measure substrate thickness (col. 3, line 60 - col. 4, line 19). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the optical metrology device, as taught by Engelhard et al., to include a first and a second sensor, as taught by Krishman et al., because then a subsequent semiconductor device could be measured in the first measurement tool while the first semiconductor device is being measured in the second measurement tool.

Response to Arguments

7. Applicant's arguments filed 11 October 2005 have been fully considered but they are not persuasive. With regard to independent claims 1 and 20, Applicant states that Engelhard et al. does not anticipate the claims because Engelhard predicts a set of subsequent parameters based on the first parameters and a correlation not the second optical metrology measurement. However, as shown above, Engelhard teach using optical metrology to determine a develop inspect (DI) and using a correlation to predict a final inspect (FI) (col. 8, line 26- col. 9, line 58, esp. col. 8, lines 37-45 and col. 8, line 64 - col. 9, line 5 Figure 4). Engelhard et al. teach measuring a FI and using the measured FI and the measured DI to calculate a correlation if the measured FI differs from the predicted FI (col. 9, lines 22-47). DI and the predicted FI correspond to the first parameters. The measured FI is the second measurement and is used along with the first parameters, DI and the predicted FI, to determine one of the second parameters, the updated correlation.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Manuel L. Barbee whose telephone number is 571-272-2212. The examiner can normally be reached on Monday-Friday from 9-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marc S. Hoff can be reached on 571-272-2216. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

mlb
May 24, 2005

Marc S Hoff
MARC S. HOFF
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800